

CLAIMS

- 1 1. A method of forwarding data over a network from a source node to a
2 destination node, comprising:
3 providing a subnetwork within the network having a plurality of
4 subnetwork nodes connected by a plurality of subnetwork links, the
5 subnetwork nodes including an ingress node and an egress node coupled to the
source node and the destination node, respectively, at least one pair of
subnetwork nodes being connected by a plurality of subnetwork links, the
plurality of subnetwork nodes and the plurality of subnetwork links defining a
plurality of subnetwork paths between the ingress node and the egress node;
forwarding a signal from the ingress node to the egress node along a
route through a subset of subnetwork nodes between the ingress node and the
egress node, said signal requesting a response from each node along the route;
and
receiving response signals from the nodes along the route, the response
signals defining a plurality of paths within the route between the ingress node
and the egress node.
- 1 2. The method of claim 1 wherein the subnetwork comprises a label-switching
2 network.
- 1 3. The method of claim 2 wherein the network comprises nodes which forward
2 data using Internet protocol node addresses.

Sub
A1

A

Sub
A2

1 4. The method of claim 2 wherein each subnetwork node along the route allocates
2 a plurality of labels for the plurality of paths along the route.

1 5. The method of claim 2 wherein:
2 the ingress node is coupled to a plurality of source nodes; and
3 each source node coupled to the ingress node is associated with one of
4 the plurality of paths along the route between the ingress node and the egress
5 node.

6. The method of claim 2 wherein:
the egress node is coupled to a plurality of destination nodes; and
each destination node coupled to the egress node is associated with one
of the plurality of paths along the route between the ingress node and the
egress node.

7. The method of claim 2 further comprising associating each packet of data to be
transferred from a particular source node to a particular destination node with
one of the plurality of paths between the ingress node and the egress node.


1 8. The method of claim 7 wherein the associating comprises performing a logical
2 operation on information carried in each packet of data.

1 9. The method of claim 8 wherein the logical operation comprises a hash
2 operation.

1 10. The method of claim 8 wherein the logical operation is performed on an
2 address field in the packet of data.

1 11. The method of claim 8 wherein the logical operation is performed on a
2 protocol field in the packet of data.

1 12. The method of claim 2 wherein a response signal includes a label word which
2 defines a plurality of data bits, a first subset of the defined data bits being
associated with the route between the ingress node and the egress node and a
second subset of the defined data bits being associated with the plurality of
paths within the route.




13. The method of claim 12 wherein the data bits of the second subset of the
defined data bits are not assigned values by the node that generated the
response signal.

14. The method of claim 12 wherein the number n of data bits in the second subset
of the defined data bits determines the number N of defined paths within the
route.

1 15. The method of claim 14 wherein $N=2^n$.

1 16. The method of claim 1 wherein:
2 the ingress node is coupled to a plurality of source nodes; and
3 each source node coupled to the ingress node is associated with one of
4 the plurality of paths along the route between the ingress node and the egress
5 node.



1 17. The method of claim 1 wherein:

2 the egress node is coupled to a plurality of destination nodes; and
3 each destination node coupled to the egress node is associated with one
4 of the plurality of paths along the route between the ingress node and the
5 egress node.

1 18. The method of claim 1 wherein a subnetwork link between a pair of
subnetwork nodes is assigned to carry a plurality of the defined paths between
the ingress node and the egress node.

19. The method of claim 1 wherein the plurality of subnetwork links connecting
the at least one pair of subnetwork nodes form a single logical link used in
forwarding the data from the ingress node to the egress node.

20. An apparatus for forwarding data over a network from a source node to a
destination node, comprising:

2 a subnetwork within the network having a plurality of subnetwork
nodes connected by a plurality of subnetwork links, the subnetwork nodes
5 including an ingress node and an egress node coupled to the source node and
6 the destination node, respectively, at least one pair of subnetwork nodes being
7 connected by a plurality of subnetwork links, the plurality of subnetwork nodes
8 and the plurality of subnetwork links defining a plurality of subnetwork paths
9 between the ingress node and the egress node; and

10 a communication subsystem within the subnetwork for (i) forwarding a
11 signal from the ingress node to the egress node along a route through a subset
12 of subnetwork nodes between the ingress node and the egress node, said signal
13 requesting a response from each node along the route, and (ii) forwarding

14 response signals from the subnetwork nodes along the route, the response
15 signals defining a plurality of paths within the route between the ingress node
16 and the egress node.

1 21. The apparatus of claim 20 wherein the subnetwork comprises a label-switching
2 network.

1 22. The apparatus of claim 21 wherein the network comprises nodes which
2 forward data using Internet protocol node addresses.

1 23. The apparatus of claim 21 wherein each subnetwork node along the route
2 allocates a plurality of labels for the plurality of paths along the route.

24. The apparatus of claim 21 wherein:
the ingress node is coupled to a plurality of source nodes; and
each source node coupled to the ingress node is associated with one of
the plurality of paths along the route between the ingress node and the egress
node.

1 25. The apparatus of claim 21 wherein:
2 the egress node is coupled to a plurality of destination nodes; and
3 each destination node coupled to the egress node is associated with one
4 of the plurality of paths along the route between the ingress node and the
5 egress node.

1 26. The apparatus of claim 21 wherein a response signal includes a label word
2 which defines a plurality of data bits, a first subset of the defined data bits
3 being associated with the route between the ingress node and the egress node

1 and a second subset of the defined data bits being associated with the plurality
2 of paths within the route.

1 27. The apparatus of claim 26 wherein the data bits of the second subset of the
2 defined data bits are not assigned values by the node that generated the
3 response signal.

1 28. The apparatus of claim 26 wherein the number n of data bits in the second
subset of the defined data bits determines the number N of defined paths within
the route.

29. The apparatus of claim 20 wherein a subnetwork link between a pair of
subnetwork nodes is assigned to carry a plurality of the defined paths between
the ingress node and the egress node

30. The apparatus of claim 20 wherein the plurality of subnetwork links
connecting the at least one pair of subnetwork nodes form a single logical link
used in forwarding the data from ingress node to the egress node.